# DIGITALIZING THE PROCESS INDUSTRY - DIGPI

*The result from the pre study for defining the future show application*

***Summary***

This document describes the results from the project "Digitalized Process Industry (DigPI)" journal number 2016-03362, managed by Lunds Universitet by Charlotta Johnsson.

This document describes the results from the project "Digitalized Process Industry (DigPI)", supported by Vinnova (diarie-number 2016-03362). The project is a pre-study project, meaning that it is a shorter project (6 months) allowing general ideas to be discussed and further specified, increasing the chances to successfully apply for a full research project.

The aim of the pre-study DigPI is to specify visions and goals for future Digitalized Process Industries and define a demonstration platform where these can be demonstrated. Start-date: 2016-10-01, End-date: 2017-03-31, Budget: 473 520 SEK.

A full research application has been submitted to Vinnova named DigiPi Living Lab".

A successful conclusion of the DigiPI Living Lab project includes establishment of a well-functioning and well-known DigiPi Living Lab center serving the process industry.

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# 1. Contents

# 2. Executive Summary

This document describes the results from the project "Digitalized Process Industry (DigPI)", supported by Vinnova (Diarienummer 2016-03362). Start-date: 2016-10-01, End-date: 2017-03-31, Budget: 473 520 SEK. The DigPI project is a pre-study project, meaning that it is a shorter project (6 months) allowing general ideas to be discussed and further specified, increasing the chances to successfully apply for a full research project. The aim of the pre-study DigPI is to specify visions and goals for future Digitalized Process Industries and define a demonstration platform where these can be demonstrated. The work was divided in 4 workpackages; WP4 Business aspects, WP3 Benchmarking, WP2 Concepts and WP1 Demonstration platform.

As a result of the pre-project Dig-PI, a full research application has been submitted to Vinnova (2017-04-06, diarienumber: 2017-02384). The full research project is referred to as "DigiPi Living Lab". The aim of the project is to set up the physical demonstration platform and to demonstrate the identified concepts. Business aspects and benchmarking will continuously be taken into account. There are 13 partners involved (11 from industry, one network organization and one academic partner). Intended start date: 2017-07-01, intended end-date: 2020-06-30, budget: 4 750 000 SEK.

A successful conclusion of the DigiPI Living Lab project includes the establishment of a well-functioning and well-recognized DigiPi Living Lab Center.

DigiPi LIVING LAB

This project will create a "Living Lab", a vendor-independent and research demonstration platform, on which various hand-on experiments, practical-education and live- demonstrations related to digitalization, smart industry, automation and process industry can take place. The Living Lab will become a leading center for expertise and provide life-long-learning opportunities to students as well as industry practitioners. The project has the name "DigiPi Living Lab". What makes the DigiPi Living Lab project unique is its broad participation of end- users, integrators, vendors, network-organizations and academy. In total, the project- consortia consist of 13 partners; 11 companies, 1 network organization and 1 partner from academia. The DigiPi Living Lab is also unique since it has a clear focus on smart industry, including automation and its impact on/of digitalization, rather than on the process or product perspectives. There is an impressive amount of knowledge, capabilities, and access to SW/HW/IT-products within the consortia, a valuable source that the consortia will leverage on. Together we can innovate and demonstrate a feasible, viable and desirable process industry of tomorrow.

# 3. INTRODUCTION

## 3.1 BACKGROUND

This document describes the results from the project "Digitalized Process Industry (DigPI)", supported by Vinnova (diarie-number 2016-03362). The project is a pre-study project, meaning that it is a shorter project (6 months) allowing general ideas to be discussed and further specified, increasing the chances to successfully apply for a full research project.

The aim of the pre-study DigPI-1 is to specify visions and goals for future Digitalized Process Industries and define a demonstration platform where these can be demonstrated.

Start-date: 2016-10-01, End-date: 2017-03-31, Budget: 473 520 SEK

## 3.2 OVERVIEW OF WORKING PROCESS

The following section described the working process used to obtain the result of this report. Furthermore, all the work packages are overall defined and described. In the next section is the result of each work package described in details.

The working process has been following a plan, made during the development of the application for this project. The plan shown in Table 1 below, shows that the project was separated into four working packages:

WP1: Identify a suitable process for the demonstration platform

WP2: Define innovative concepts to be visualised in the demonstration platform

WP3: Benchmark within the process industry

WP4: Understanding of business benefits

Furthermore, the overall coordination is made on common meetings as indicated on the original plan, and the activities were managed by Lund University and SESAM. Each of the four working packages had a chairman that was responsible for the coordination within the specific working group.

**Table 1: The original plan that was followed during the execution of the project.**

| | General | WP1 (demonstration platform) | WP2 (innovative concepts) | WP3 (bench-marking) | WP4 (business benefits) |
|---|---|---|---|---|---|
| **Aug 2016** | Preparation meeting | | | | |
| **End-sept 2016** | Kick off meeting | | | | |
| **Oct 2016** | Project meeting 1 | | | | |
| **Nov 2016** | | Demonstration process selected | | National benchmarking done | |

| | General | WP1 (demonstration platform) | WP2 (innovative concepts) | WP3 (bench-marking) | WP4 (business benefits) |
|---|---|---|---|---|---|
| **Dec 2016** | Project-meeting 2 | | Concept iteration 1 | | Prel. results |
| **Jan 2017** | Project meeting 3 | Sketch of demonstration process | Concept-iteration 2 | | |
| **Feb 2017** | | Detailed info demonstration process | Concept-iteration 3 | International benchmarking done | |
| **Mar 2017** | Project meeting 4, focus on new application | Results available | Results available | Results available | Results available |
| **Mar 2017** | Submit new application (DigPI-2) | | | | |

## 3.3 LIST OF PEOPLE INVOLVED IN PROJECT

The following people, see Table 2, served as active participants in preparation of this technical report and the application for the future project.

**Table 2: List of people involved in the preparation of this technical report**

| Indicate all the resources from the company that will be involved in<br>• **WP1: Identify a suitable process for the demonstration platform** | | |
|---|---|---|
| Name | Mail | Phone |
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| Indicate all the resources from the company that will be involved in<br>• **WP2: Define innovative concepts to be visualised in the demonstration platform** | | |
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Indicate all the resources from the company that will be involved in

- **WP4: Understanding of business benefits**

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## 3.4 Relation to Vinnova and the Strategic Innovation Programs

Vinnova is the Swedish Innovation Agency (www.vinnova.se). The aim is to develop Sweden's innovation capacity and sustainable growth and benefiting society. Digitalization is currently one very important aspect. Vinnova has generated several reports in this area, e.g.:

- Digitalisering av svensk industri
- Future Smart Industry

Vinnova has several different initiatives that should encourage and make it possible for academia, SMEs and corporations to invest in innovations linked to e.g. Digitalization. One such initiative is the Strategic Innovation Programs (SIP). There are currently 17 SIPs, some examples are:

- Process Industrial IT and Innovation (PiiA)
- Production 2030 (Prod2030)
- Internet of Things Sweden (IoT Sweden)
- Gruv och metallutvinning
- Etc, etc.

The aim of SIP-PiiA is threefold; to create insights and understandings, to show and demonstrate, and to help introducing aspects related to the development and usage of innovative and competitive solutions with process industrial IT and Automation. PiiA accepts applications for new innovative projects twice per year.

# 4. Work Packages

## 4.1 Business reasons and motivations for digitalizing

The goal for WP4 of the Dig-PI project is to find the business sense and use for the customer or even the customers' customer, i.e. all developments have to meet a need and/or bridge a gap for having a general purpose. Not always these are obvious at the beginning of a project so therefore this project have tried to think and generate ideas "outside the box" but still with defined business benefits. No general effort has been made to quantify the benefits.

In order to focus the ideas to the topic the generic question "What are the challenges and goals for the Process Industries?" was put forward.

The ideas generated have been classified into the following areas/main topics, see Figure 1:

- Time to market
- Flexible production
- Crowd sourcing, Scalability, Process Industry as a Service (PIaaS)
- Environmental benefit
- Transforming big data to business value.
- Unmanned process operation
- Reduced double-work, right-first time and Safety
- Quality

Generally the topics are very interlinked in such manner that one is dependent on the other.


**Figure 1: Classification of ideas**

### 4.1.1 Time to market

In the globalized world with a rapid pace of development time to market is of greatest importance to be competitive and successful. To realize a short time to market concepts like flexible production, simulation etc. are key enablers.

### 4.1.2 Flexible production

Flexible production is a key factor to be able to react fast on shifting market demands. To be able to realize this there are key enablers like: Good separation of process parameters (how the actual process hardware behaves) and product recipe parameters (what needs to be done to produce the product) is necessary. This separation would enable subcontracting, in its extreme form Crowd sourcing, for covering peaks, but is also a fundament to be able to set-up new production facilities with the "right first time".

Another view of the topic is to be able to reconfigure a plant into a completely different set-up if a production is set-up as parts of functions like reactor module, mixing module, heating module etc., modules with its own intelligence and interconnectivity. This would also promote reusability and would be environmental friendly.

### 4.1.3 Crowd sourcing

If product innovations and IPR, i.e. recipe, is owned by a brand and is well defined an IPR owner could own a brand but would not need to own its own plants.

This is today a fact in higher volume manufacturing for example manufacturing of base pharmaceutical substances. In a future more connected world the local grocery store could buy only base milk and dose jam and additives locally after local demand. This would drive personalization of products and would be an environmental benefit with its possibilities to minimize product waste.

Develop solutions that can help process industry to scale their production fast and more effective. For example, how to go from laboratory setup to full production. What tools are required and how should the process system be developed to full fill the requirement.

Scalability can also be seen as a concept for developing *Process Industry as a Service* (PIaaS), where companies can get their products produced at a production company and not by the company itself.

### 4.1.4 Environmental benefit

In the future successful companies are most likely also environmental friendly. In the line of environmental friendliness local production, less product waste and transportation, are key. All innovations in the field of environmental benefits will be important and have a business value, not at least in the field of marketing and company profiling.

Energy savings via simulation and digital twin.

### 4.1.5 Transforming big data to business value

Today we see solutions with data collection. The future direction with vertical "sensor 2 cloud" digital connections will increase the data logged and available. However the future demands will not only be data, it will be data and **information** transparency, i.e. what information is hiding inside the data. Therefor data collection systems and data mining will be important.

Typical applications can be consumers checking ingredients via apps scanning a dot matrix code in grocery store and business to government contacts for effluent regulation and follow-ups.

### 4.1.6 Unmanned process operation

The best operating process is the automatic process. At its extreme it is unmanned. This can be seen from a pure economic angle, i.e. reducing staff to reduce cost or as an opportunity to free experienced operators in Kaizen improvement project without additional cost.

### 4.1.7 Reduced double-work, right-first time and safety

Digital Simulation and modeling of processes whole plant and operation of plants ahead of physically building and testing plants implies an increased probability of reduction in double work and right-first time. Also the likelihood of reaching project schedules and targets on-time is increased reducing time to market.

Simulation and modeling will most probably also be positive in the sense that they can be used to train operators and therefore reduce risks of human errors in the live process, increasing safety both for personnel and environment.

The above is also possible to connect to investment safety. High confidence in result early in projects reduces the financial risk and therefore contributes to investment safety. Maintaining the models during the lifetime of the process will even strengthen this since alterations and rebuilds can be done virtually and therefore be tested and evaluated in advance to the physical change is made.

### 4.1.8 Quality

Right quality - The quality needs to be related to the product. One issue could be release products on process control data only. This would require that the data flow and product flow are in control. Show that the process is in control and then the product is also in control. A type of parametric release of products.

Controllable quality - connects to big data. By using Internet of Things (IoT) or Industrial Internet of Things (IIoT) sensors combined with the possibility to store data in the Cloud develop methods and tools that can give a simple and cheap method to measure the process and report back to the Cloud. In the Cloud the analytic tools can be used to find the algorithm for improvement.

Productivity – machinery uptime. Figure out how simple sensor technology and IT systems can measure and calculate the performance for the process equipment and machines. Find digital tools for communicating with the Operator, Maintenance personal, Planning personal, etc. How is the future tool for communication is it a mobile device, is it glasses (eg. HoloLenz, GoogleGlass,…).

## 4.2 BENCHMARKING

The goal for WP3 of the Dig-PI project is to find out other projects in the same area as this project. During the Dig-PI project five demonstration platforms have been identified, and there have been an dialogue with the projects. The projects have been examined to get inspiration to how the future platform of the Dig-PI project should look like.

The five demonstration platforms that have been identified and examined are:

A. Smart Factory in Kaiserslautern, Germany
    - Smart Factory in Kaiserslautern is an association of several companies that together demonstrate industry 4.0.
    - Charlotta Johnsson visited Smart Factory, Kaiserslautern, in March 2017.
    - http://www.smartfactory-kl.de
    - https://www.youtube.com/watch?v=9R_P8FpslBY
B. Siemens process industry demo-center
    - Siemens has a process industry demo center in Karlsruhe, "Process Automation World", focusing on displaying digitalization in the process industry and having both a physical model of process and control room, but also a digital twin.
    - Charlotta Johnsson, Thomas Andersson and Mikael Börjesson visited Siemens demo-center in March 2017.
C. Rockwell Automation
    - Rockwell Automation has a demo center in Karlsruhe focusing on Digitalization and MES platform.
D. Au2mate
    - Au2mate has a demo of a dairy. Physically small dairy is structured and controlled to this.
E. Discrete industry
    - Göteborg's College - Volvo has a demo facility in Gothenburg ("production of cars")

## 4.3 THE DEMONSTRATION PLATFORM AND CONCEPTS

The goal for WP1 and WP2 of the Dig-PI project is to describe how the demonstration platform should be constructed and which concepts should be included.

The group started to discuss some overall demands they have on the demonstration platform and the concepts (4.3.1), the group agreed on 5 concepts that they ranked as the most interesting ones to start to explore in a future project (4.3.2) and the group made three iterations of a physical demonstration setup (4.3.3).

### 4.3.1 Overall demands

The group discussed the following ten (10) questions and three (3) scenarios:

Question 1: What should DigPI project be able to show:

- Something innovative
- What we can do with today's technology, and what can process industry benefit from this?

Question 2: What's up with digitization:

- Personification (ie to get its own variant of a product).
- Fast delivery time.
- High degree of automated manufacturing.

- Machine redundancy – i.e. "on the fly" can swap a machine with its control against another machine including control. Today, only control is redundant, not machine including control.

Question 3: What we produce - the product - is of secondary importance: however, it must be:

- Easy to handle!
- Not explosive
- Non-sensitive foods
- Feel liquid material. Direct connection to process industry, pumpable during the process.
- Using color is very visual, i.e. coloring is good to show off. Can we use RGB coloring?
- It is appropriate to have a product that is largely based on water.

Question 4: How should the process be:

- How many steps should this include?
- Should be able to demonstrate the concept "Batch size one", i.e. personalized manufacturing.
- Flows are important, they are in process industry.
- Mix, dose, pack, label is a good step to show off.
- What happens before and after - Supply Chain. Customer orders come in and the product is produced and then send out to customer. The whole supply chain should be completely automated.
- Billing and accounting can only be provided as an interface (not displayed)
- Easy to move, i.e. take a seat from one place to another. Do not be too big. It's going into a truck.

Question 5: Foundations about the role of the operator:

- Create an artificial operator (AI) for each process step.
- The equipment should diagnose itself, it does not require the operator.
- The machine should not provide different qualities depending on who is operating it.
- Operator devotes more attention to "round" operations.
- Cloud services should be used in larger equipment (e.g. maintenance).
- The administrative systems (purchases, etc.) can be combined with cloud services.

Question 6: What do we have for the process equipment requirements:

- Pumps (usually in process industry)
- Valves (usually in process industry)
- Tank (to keep raw material)
- Must be mobile. So that we can show you how to switch one device to another (machine redundancy).
- Each module must be designed in a special way so that each part can be replaced.

Question 7: Size of modules:

- Approx. 1m x 1m x 1.5m
- The modules should have wheels so that they can be rolled.
- The control is in the lower part of the modules and the interesting (equipment / process) is at eye level.

Question 8: Suggestion for setup:

- Six modules: (dual set of all: same function but different implemented)
    1. Module 1: raw material module
    2. Module-2: mixer tank
    3. Module-3: Destination tank
    4. Module 4: Temperature Control Module (TCM)
    5. Module 5: fill module
    6. Module-6: label module

Question 9: What kind of process:

- A cup of coffee
- Cold or hot drink, mug with name on.
- Shampoo / soap
- Festis / Mer (Talk to those who make Festis owned by Carlsberg).

Question 10: Are there other ideas:

- Voice control
- The machine parts may be AGVs as when they self-diagnosed, sending themselves to service.
- If the parts of the machine are to be redundant, they may have different solutions internally in the module (eg gravimetric dosing and flow rate, respectively), but have identical function and identical interface to the other machine.

Scenario-1: Environmental aspects will become more important in the future -> transportation will decrease -> local factories will increase -> factories will be smaller and more flexible to serve a geographical area -> Minifactories (MiniDigiPI) supporting modularization is key!

- This might not be true for the Bulk industry. Here it goes in the other direction with larger production facilities.
- Brown-field are not built in this way, but if they would have been, it would have been an advantage. Green-fields should be built with a high level of Modularization.

Scenario-2: Data power and memory will be low cost -> more IT application supporting automatization will be seen -> there will be many suppliers -> integration build on standards is key!

- It will be easier when changing existing systems. Today it is very difficult to change one application from another.
- A lot of data is hidden in the back today, we cannot use it because the data cannot be made transparent and used by different applications. Interoperability is important!
- Today most IT systems are bought from the same vendor. This is a lock-in syndrome which is not good. Interoperability will solve this.

Scenario-3: Operators will have new roles -> operators to act as ”Supervisors” -> operators will need fast and accurate info about a wide range of IT applications, units, products etc.

- Operators are more Supervisors and Troubleshooting – they have to have support for this!

### 4.3.2 Definition of Concepts

This section contains the concepts to be demonstrated in the coming DigPI project:

Concept-1: Modularization of functionality and physical equipment

- Functionality:
  - We can be inspired by ISA88 concepts.
  - What is the best practice to describe a function?
- Physical equipment: this links to WP1 and the layout of demonstration plattform. Suggestion:
  - Module-1: raw material module
  - Module-2: mixer tank
  - Module-3: destination tank
  - Module-4: temperature-control-module (TCM)
  - Module-5: fill-module
  - Module-6: label-module
- Different technology
- IT structure point of view

Concept-2: Context based information (operations will be automated. Operators will do supervision and maintenance)

- Information during operation or maintenance or other perspectives.
- Information based on geographical location
- Information for business perspectives (money-meter in the control rooms).
- Augmented reality for context based information as a way to show values superimposed on the equiment. Vendors to contact: Google (Googles), DAQRI (Helmets), Microsoft (HoloLens), Augmensys (Tablets, googles).

Concept-3: Digital Twin

- Drowning in data but staving in information. All the data saved needs to be saved associated to its right digital twin, and from there information can be determined. Digital Twin is the hub.

Concept-4: Standard awareness and compliance

- Standards 15926 (exchange of process drawing. Interoperability of e.g. P&ID), IEC 18346 (Systems Engineering, name convention from a functional view), IEC/ISO 62264 (ISA95), IEC 61512 (ISA 88), ISA 99 (Cybersecurity), E-class standards (), Automation ML, OPC-UA.

Concept-5: Cloud-based applications

- Companies to involve: Ericsson (5G, platform).
- Consolidate data. Connect your drive to a cloud, data to be analysed and feedback provided to you.
- Companies:
- Infrastructure as a service, Big data analytics, Functionality as a service, service providers (maintenance supplier), simulation.
- Do the physical equipment providers have something in cloud. A lot of vendors are moving this way.
- IBM Watson – (AI included).

### 4.3.3 Illustration of Physical Process

This section describes and illustrates the physical process that the DigPI project wants to create. This work was done as three (3) iterations.

Iteration-1: "MyJuice" consists of three modules (see Fig.2): Mixing, Cooling, Filling & Labeling

- The three modules have the same physical dimensions (e.g. 1 * 1 meters), type a square desk. The legs of the module have wheels. On top of the module desktop, the equipment (tanks, heater / cooler, etc.) is located under the module desktop. The equipment is equipped with automation.
- The customer should be able to place an order for which juice they want; Quantity (number of bottles), flavor, color, temperature and label (for example, photo).
- The customer places the order through an App (and pays via Swish).
- The customer sends a Selfi printed on the label.
- The customer must be able to follow the order and manufacture in the App.

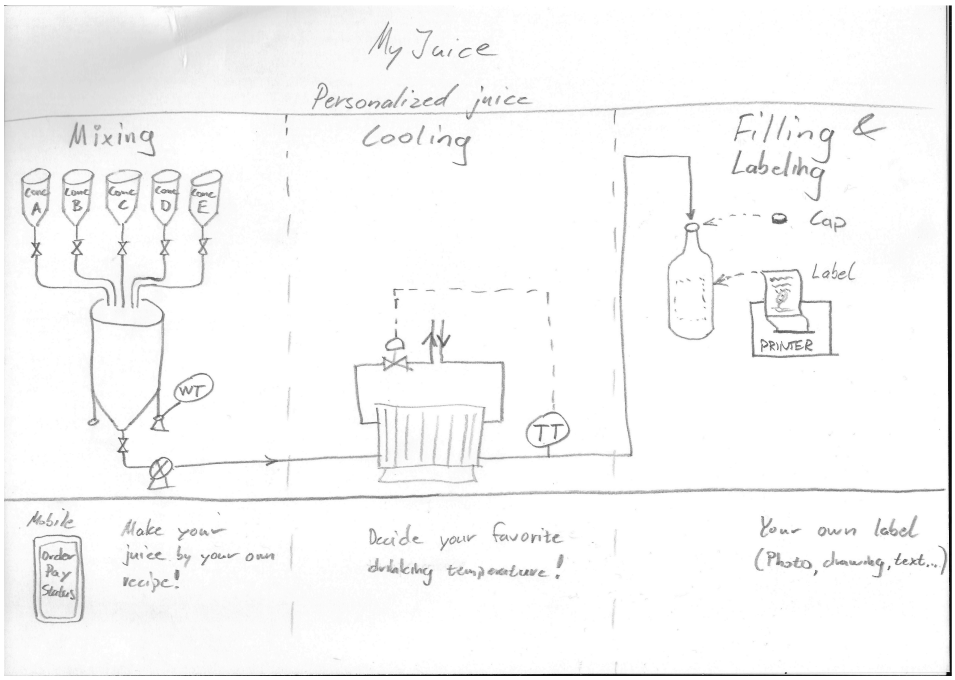



**Figure 2: A proposal for a process is "MyJuice".**

Iteration-2: Definition of modules (see Fig.3,4,5 and 6):

- Module-1: raw material module
- Module-2: mixer tank
- Module-3: destination tank
- Module-4: temperature-control-module (TCM)
- Module-5: fill-module
- Module-6: label-module

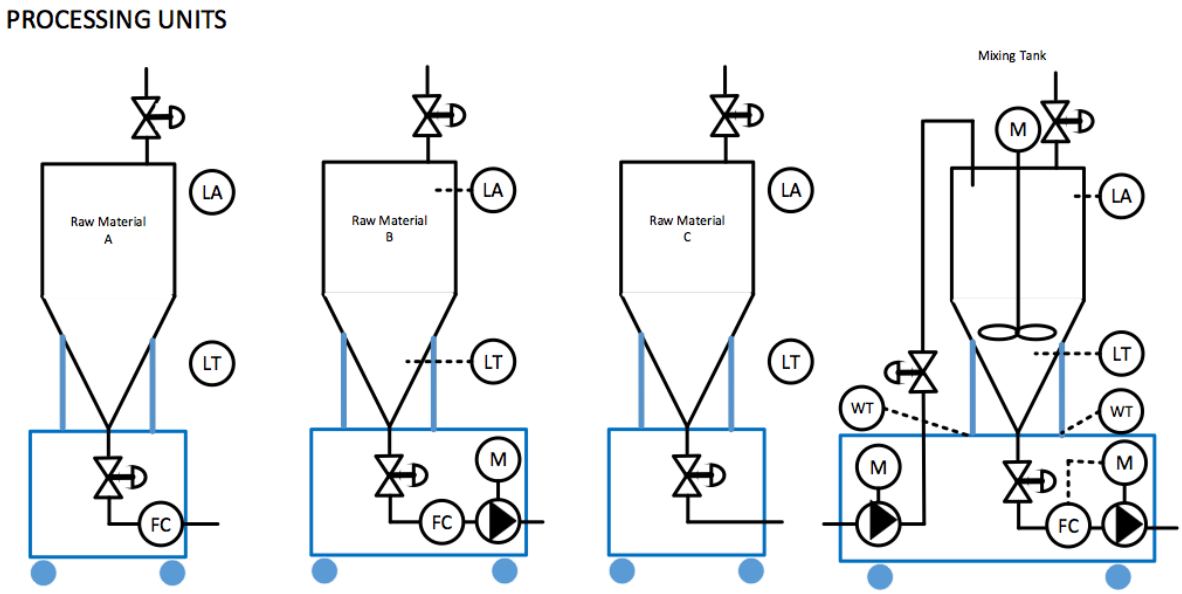



Figure 3: Example of process units

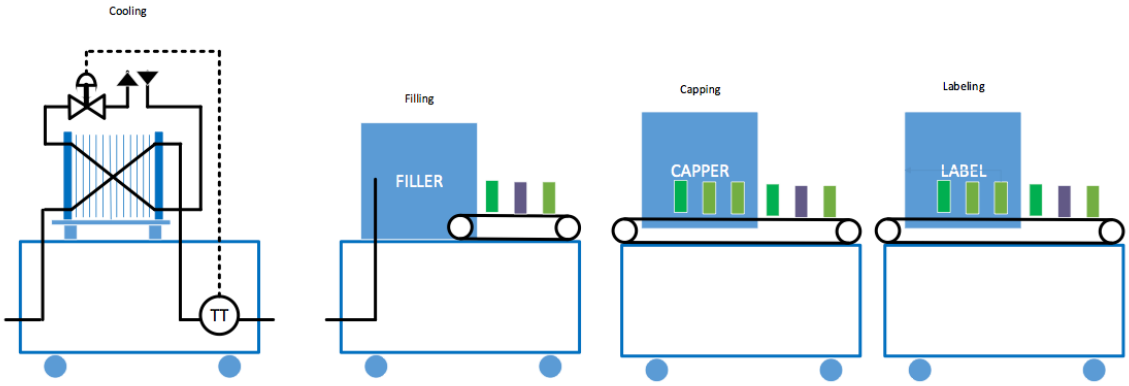



Figure 4: Example of process units

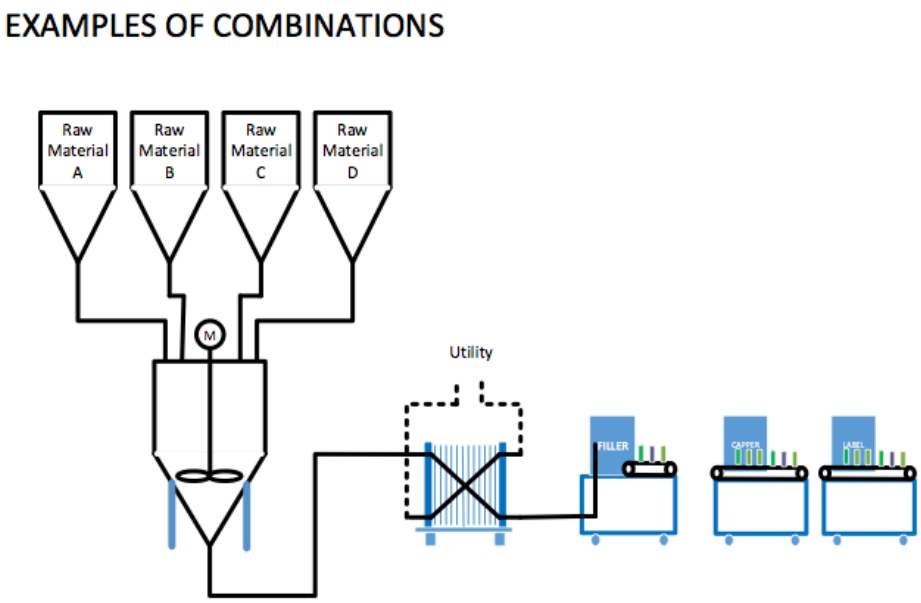



**Figure 5: Example of combination of Process Units**

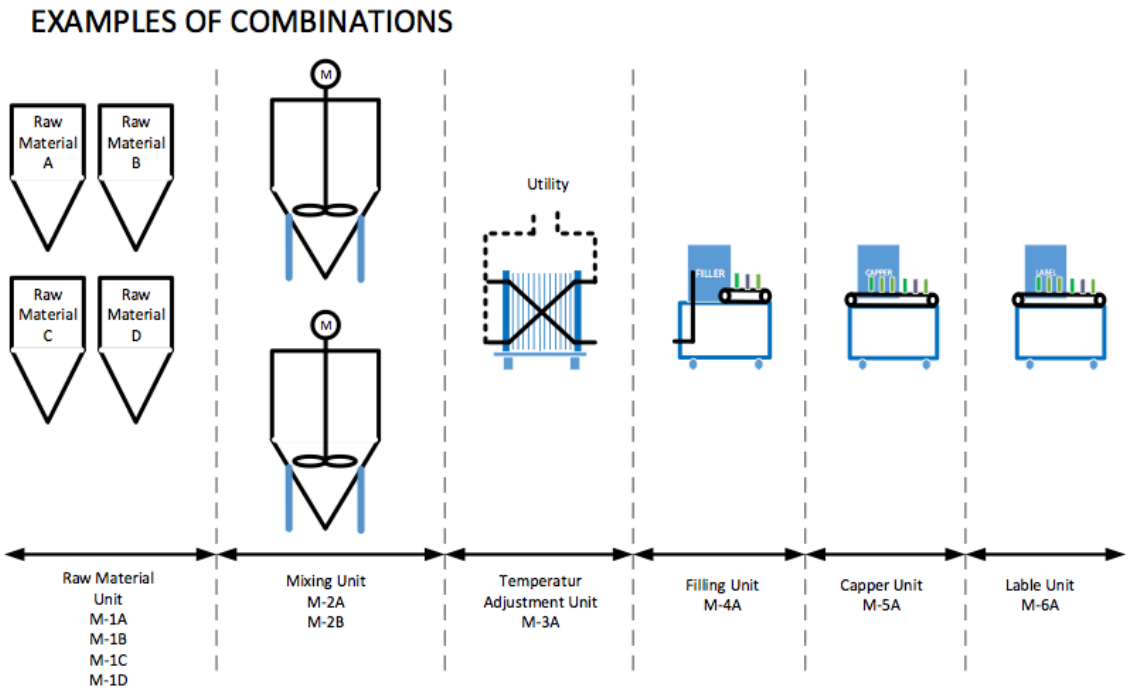



**Figure 6: The maximum variation of process units related to the demonstration platform.**

Iteration-3: Soap-production platform coming from Smart Factory.

The physical demonstration platform below (see Fig 8 and Fig. 9) is available at Smart Factory in Kaiserslautern, and also available for us to buy to an attractive price. Not having to spend time (or money) on constructing a the physical platform was considered an advantage.

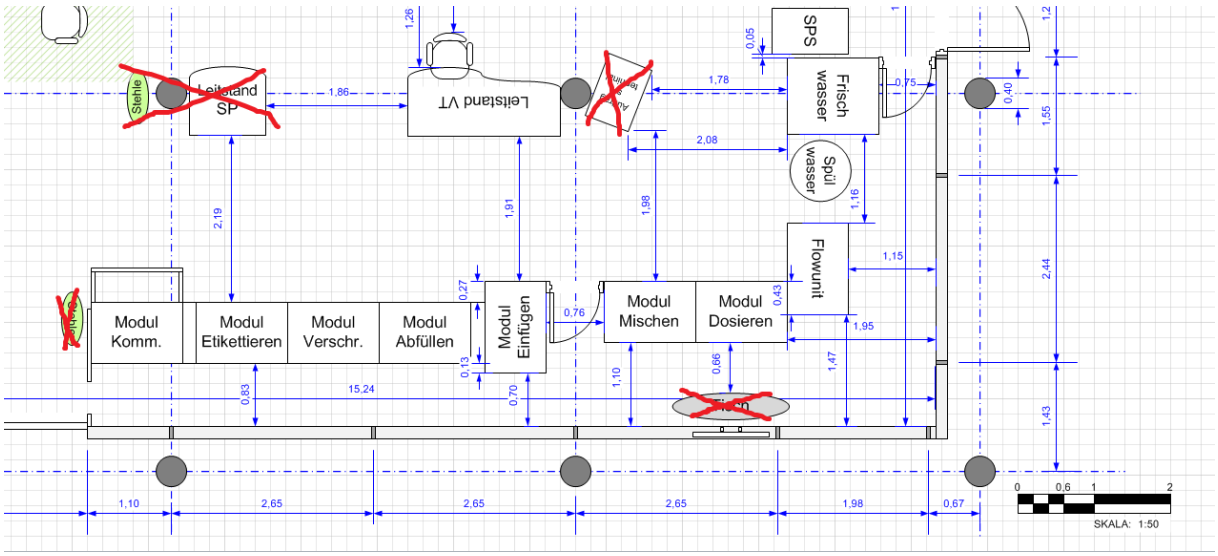



**Figure 7: A sketch of the physical demonstration platform.**

**Figure 8: Photos of the physical demonstration plattform as set up in Kaiserslautern, Germany.**

# 5. Working plan for Future activities

## 5.1 ”DigiPi Living Lab”

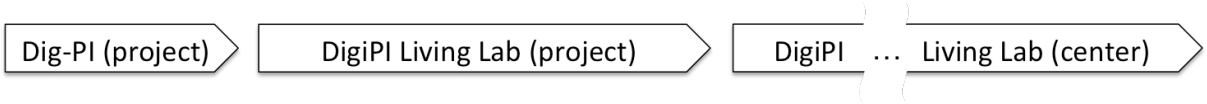
This project will create a ”Living Lab”, a vendor-independent and research demonstration platform, on which various hand-on experiments, practical-education and live- demonstrations related to Digitalization, Automation and Process Industries can take place. The Living Lab will become a leading center for expertise and provide life-long-learning opportunities to students as well as industry practitioners. The project has the name ”DigiPi Living Lab” will be a continuation on this ”DigPI” pre-project (Diarie-nr: 2016-03362)).

What makes the DigiPi Living Lab project unique is its broad participation of end-users, integrators, vendors, network-organizations and academy. In total, the project-consortia consist of 13 partners; 11 companies, 1 network organization and 1 partner from academia. The DigiPi Living Lab is also unique since it has a clear focus on Smart Industry, including automation and its impact on/of digitalization, rather than on the process or product perspectives. There is an impressive amount of knowledge, capabilities, and access to SW/HW/IT-products within the consortia, a valuable source that the consortia will leverage on. Together we can innovate and demonstrate a feasible, viable and desirable process industry of tomorrow.

The consortia has (through the DigPI pre-project) gained a consensus knowledge regarding major business benefits relating to the Process Industry, as well as awareness of other available Living Labs, or similar setups, in Sweden and Europe. A source of inspiration is ”Smart Factory in Kaiserslautern, (Germany)”, a consortia like ours, that has been successfully active for 10+ years (SmartFactory, 2017-03-10).

We believe that Sweden is a very suitable location for the DigiPi Living Lab because of the country’s long and strong position in the Process Industry as well as the significant role it plays in our country’s economy. A DigiPi Living Lab will clearly strengthen Sweden’s international position as a global leader in the area of Process industrial IT and Automation. We also believe that the possibilities to make hands-on experience and live demonstrations on a vendor-neutral and research intensive demonstration platform is vital for competence development of industrial practitioners as well as employees-to-be (i.e. students).

A successful conclusion of the DigiPI Living Lab project includes the establishment of a well-functioning and well-recognized DigiPi Living Lab Center serving the process industry.




*Note:* A living lab is a user-centered, open-innovation ecosystem, often operating in a territorial context (e.g. city, agglomeration, region), integrating concurrent research and innovation processes within a public-private-people partnership.(Wikipedia, 2017-03-10).

# 6. FINAL VISION AND GOALS

## 6.1 VISION

The pre-study DigPI has specified a vision and goals for future Digitalized Process Industries and it has defined a demonstration platform where these can be demonstrated.

The vision is to position Swedish Process Industry as a forerunner regarding the use of digitalization for improving business. Furthermore, the vision is to develop a center/environment that combines process control and digitalization, and that can be used by the Swedish Process Industry to get knowledge and inspiration on the possibilities with digitalization.

The center will be recognized as an organisation, which supply quality solutions (In the future the project is to be know as the DigiPI Living Lab:

- strategically consulting for automation, digitization and use of IT in the supply chain that provide customers with a stronger business within process industry in Sweden.
- Implementation Plans and project definitions to match customers' IT maturity level. Ensure business processes, organization and corporate culture is optimally supported by IT.

To create digital strategies and associated plans that ensure optimal interaction between business processes, organization, corporate culture and digital systems, enhance the Process Industry business, competitiveness and service.

The center will be able to determine how to achieve optimal utilization of IT investments within the plant of the Process Industry

- Digital Readiness and culture
- Business Processes
- Current digital solutions
- Automation Level

Ensure knowledge and advice on digitization and how it can help Process Industry companies to enhance their business.

The center will create a link between automation and IT and ensure that supply chain including production can be optimized in order to strengthen the business of Process Industry.

The center can describe the needs and opportunities by using IT in the supply chain of Process Industry. Additionally The center point to holistic solutions that include several disciplines..

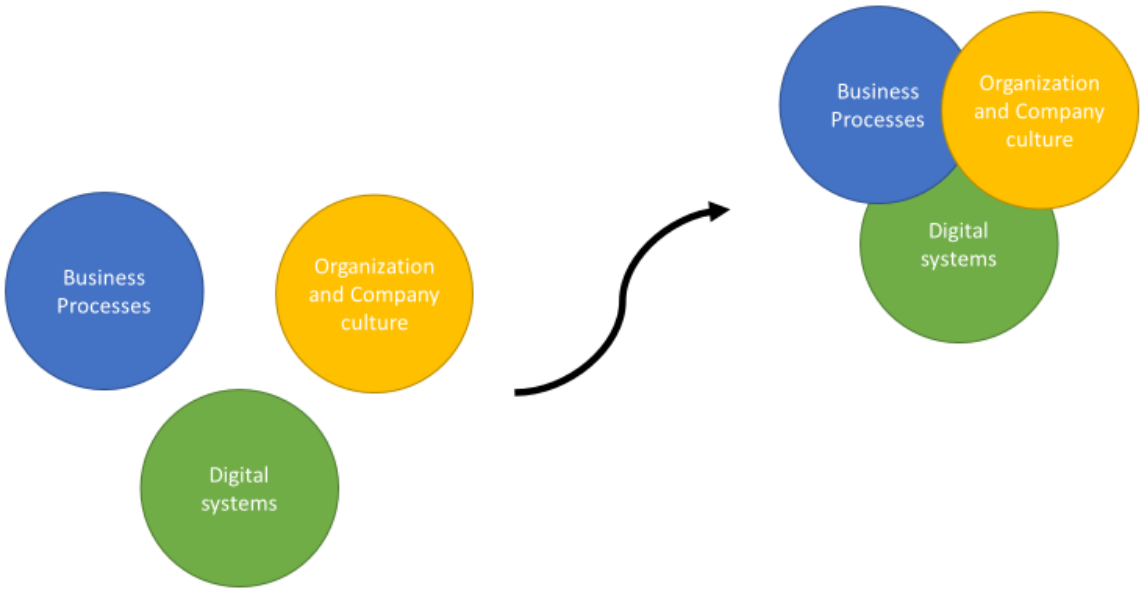



**Figure 7: Creating coherent digital solutions that support business processes and corporate culture**

## 6.2 MISSION

The center will cover a need that exists for creating the optimal use of IT throughout the supply chain in Process Industry - a digital strategy. One needs to ensure that they can achieve improved competitive ability and its improved business through better use of resources, better and more consistent quality.

A production IT strategy that makes it possible to support the following requirements:

- There are constantly documentation for both tangible and intangible values
- Each employee has easy accessibility to data, systems and information.
- Supports knowledge sharing within the organization
- Production can be controlled optimally
- Organisation and processes can be organized efficiently and flexibly
- Supports decentralized decision-making and framework
- Increase cohesion and flexibility of the company
- Enable a target-guided leadership
- Supports service to customers throughout the supply chain
- Ensure optimal utilization of resources by better planning

Being the popular and recognized supplier of digital strategies that create business value for customers within the Process Industry

The center will provide a basis for the customers so that they get the best possible use of the IT and get the IT implemented at a pace that matches the IT maturity level. Creating the following:

- Management consultancy
- Strategies and implementation plans
- Investment plans for digitization
- Business Analysis of the potential of digitization

## 6.3 AIMS

The center will focus on exploiting the advantages that Process Industry companies must have, by utilizing digital solutions to support their business processes, organization and corporate culture.

The center focus on improving customer utilization of resources in terms of manpower, machines and equipment, raw materials, energy, etc..

To achieve an experience of a coherent organization, it is not the individual employee or individual departments to perform. To achieve this, it is required organizational integration between all parts of the company. This can be ensured by workflows and information flows freely across departments and production categories. The digital strategy including IT strategy and the associated infrastructure can either inhibit or promote organizational integration.

There is no question of isolated digital solutions, but coherent digital solutions where information flows freely and can be made available to employees and customers in a way that is defined by need. The price for non-digital integration, inadequate organizational integration and poor conditions for employees to provide customers with the best service will be manufactured in a digital strategy.

## 6.4 GOALS

The goals for the center are the following

- Establish a physical environment where new applications can be tested
- Establish an organization that can be a strategic partner for the Process Industry in respect to digitalization of processes.
- Establish an education program for employees at industry and students at different education institutions.

# 7. SUMMARY

This document describes the results from the project "Digitalized Process Industry (DigPI)", supported by Vinnova (diarie-number 2016-03362). The project is a pre-study project, meaning that it is a shorter project (6 months) allowing general ideas to be discussed and further specified, increasing the chances to successfully apply for a full research project.

The aim of the pre-study DigPI is to specify visions and goals for future Digitalized Process Industries and define a demonstration platform where these can be demonstrated. Start-date: 2016-10-01, End-date: 2017-03-31, Budget: 473 520 SEK.

A full research application has been submitted to Vinnova "DigiPi Living Lab" (see section 5). The aim of the project is to set up the physical demonstration platform (see section 4.3.4, iteration-.3) and to demonstrate the 5 concepts (see 4.3.2). Business aspects and benchmarking will continuously be taken into account. There are 13 partners involved (11 from industry, one network organization and one academic partner). Intended start date: 2017-07-01, intended end-date: 2020-06-30, budget: 4 750 000 SEK.

A successful conclusion of the DigiPI Living Lab project includes establishment of a well-functioning and well-recognized DigiPi Living Lab Center serving the process industry (see section 6).

# 8. REFERENCE INFORMATION

## 8.1 DEFINITIONS AND ABBREVIATIONS

| Abbreviation | Description | Explanation |
|---|---|---|
| DCS | Distributed Control System | A distributed control system is a control system for a process or plant, in which autonomous controllers are distributed throughout the system, but there is central operator supervisory control. |
| HMI | Human Machine Interface | Human machine interface is the part of the unit/machine that handles the human to machine interactions. |
| ISA | The International Society of Automation | ISA is a non-profit technical society for engineers, technicians, businesspeople, educators and students, who work, study or are interested in industrial automation and pursuits related to it. |
| LC | Line Controller | Line Controller can be part of a Supervisory Control System. A Line Controller controls a number of Units in a line. |
| MES | Manufacturing Execution System | System software to integrate customer orders in the ERP system and to program sequences for SCADA and PLC systems. |
| OEE | Overall Equipment Effectiveness | OEE measurement is commonly used as a key performance indicator (KPI) in conjunction with manufacturing efforts to provide an indicator of success. |
| OEM | Original Equipment Manufacturer | OEM are manufacturing products or components bought by another company and sold under the purchasing company's brand or company name. |
| PIaaS | Process Industry as a Service | A third part can produce a product on a Process plant. |
| PLC | Programmable Logic Controller | A computer controlling instruments, motors, valves, etc. |
| SCADA | Supervisory Control and Data Acquisition | The SCADA system normally log data from units/machines and monitors the unit status. The SCADA is often a HMI for a set of units/machines put together in a Production Line. |

## 8.2 REFERENCES

**Table 3: List of references**

| Ref. no. | Document |
|---|---|
| [S88-1] | ANSI/ISA-88.00.01-2010, Batch Control, Part 1: Models and Terminologies. |
| [S88-5] | ISA/DRAFT-88.00.05-2013, Working Draft 08, Batch Control, Part 5: Implementation Models & Terminologies for Modular Equipment Control. |
| [S95] | ANSI/ISA-95.00.01-2000, Enterprise-Control System Integration Part 1: Models and Terminology |

# 9. APPENDIX

## 9.1 APPENDIX 1: MEETINGS

| | Date | Place |
|---|---|---|
| ALL | | |
| | 2016-12-06 | ÅF Industry, malmö |
| | | Tetra Pak, Lund |
| | 2017-02-02 | Arla, Kvibille |
| | 2017-02-15 | Lund University |
| | 2017-03-15 | Rockwell, Lund |
| WP-1 | | |
| | 2016-11-11 | teleconf |
| | 2016-11-30 | teleconf |
| | 2017-01-23 | Siemens, Malmö |
| | 2017-02-15 | Lund university |
| WP-2 | | |
| | 2016-11-21 | Perstorp AB, Perstorp |
| | 2016-12-12 | teleconf |
| | 2017-01-20 | Perstorp AB, Perstorp |
| | 2017-02-15 | Lund university |
| WP3 | | |
| | 2016-11-xx | teleconf |
| | 2016-12-20 | teleconf |
| | 2017-01-18 | teleconf |
| | 2017-02-15 | Lund university |
| WP4 | | |
| | 2016-11-15 | B&R Automation, Malmöm |
| | 2016-12-01 | Prevas, Malmö |
| | 2017-02-15 | Lund university |

## 9.2 APPENDIX 2: PARTNERS

| **Partner** | **Contact info** |
|---|---|
| Arla | www.arla.se |
| B&R Automation | www.br-automation.com |
| FPA | www.fpa.se |
| Hild | www.hild.dk |
| Lunds universitet, LTH | www.lth.se |
| Modelon | www.modelon.com |
| Perstorp AB | www.perstorp.com |
| Prevas | www.prevas.se |
| Rockwell Automation | www.rockwellautomation.com |
| Schneider-Electric | www.schneider-electric.se/sv/ |
| SESAM-Sverige | www.sesam-world.com |
| Siemens | www.siemens.se |
| Tetra Pak | www.tetrapak.com |
| ÅF Industry | www.afconsult.com |